Case Report

Isolated coronal split fracture of the trapezium

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Abstract

Trapezium fractures account for <5% of all carpal fractures. Of these about 20% are vertical sagittal fractures of the body of trapezium and are classified as type IV. We report a case of coronal fracture of the trapezium, which was treated by open reduction and internal fixation with Kirschner wires and ligamentotaxis by external fixator. This fracture pattern has not been reported before.

Key words: Carpal bones, trapezium carpometacarpal joint, internal fixation, open reduction

Introduction

The carpometacarpal joint (CMC) of the thumb contributes primarily to the prehension, opposition, and circumduction of the thumb.[1] Any damage to the articular surface of the trapezium or the base of the first metacarpal leads to restriction of all ranges of movements from extension through abduction to flexion.[2] This includes fractures of the base of the first metacarpal and trapezium and CMC joint dislocations. Fractures of the trapezium account for about 5% of all carpal bone fractures.[1-6] Of these, about 20% are vertical sagittal split fractures occur rarely in isolation. Various methods of treatment have been described[3,6-10] to regain the articular congruity.

Case Report

A 40-year-old right hand dominant male patient presented with pain in the left hand due to a fall on the out stretched hand. He had pain and tenderness over the base of the first ray. A bony fragment was felt over the dorsum of the hand near the anatomical snuff box. Movements of his thumb was only restricted in the terminal range.

Plain radiographs of the left hand showed a coronal fracture of the trapezium, with the base of the first metacarpal impacted in between the two fragments. A reduction was attempted in the emergency room under intravenous sedation, which showed the fracture geometry more clearly in the immediate postreduction radiographs. CT scan was asked for better evaluation [Figures 1 and 2] which confirmed the coronal split fracture of the trapezium with articular involvement. There was a major volar fragment and a dorsal fragment [Figure 2].

Under general anesthesia and tourniquet control the fracture was exposed through a dorsoradial approach. The fracture was well visible through the tear in the capsule. The fragments were reduced and held with a reduction clamp. Our original plan was to fix the fragments with a 2.7 mm screw, passed from the dorsal fragment. However, tightening of the screw to get compression resulted in fragmentation of the dorsal fragment. Hence the fragments were fixed with two, 1.6 mm Kirschner wires [Figure 2]. To keep the joint reduced and to maintain the articular congruity, the joint was stabilized further with a joint spanning mini fixator. The

Figure 1: Anteroposterior radiograph of the wrist (a) showing the coronal fracture of the trapezium (b) after attempted reduction showing minimal subluxation of the CMC joint

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Access this article online	
Quick Response Code:	Website: www.ijoonline.com
	DOI: 10.4103/0019-5413.91643

K wires and the external fixator were removed at 6 weeks, and the patient was sent for hand physiotherapy where he was started with an active and active assisted range of movements [Figure 3].

At 1-year follow-up radiographs showed normal articular relationship of the trapezium with the base of first metacarpal and scaphoid. The anatomic relationship of the bases of the first and second metacarpal was also maintained. He had a complete range of motion of the left thumb, when compared to the uninjured side. His grip strength was normal.

Discussion

Different types of trapezium fractures have been documented in the literature which includes avulsions, vertical, sagittal, comminuted, coronal, and horizontal fractures. Walker *et al*. classified fractures of the body of the trapezium into five types based on the articular surface involved.[4] Walker's classification distinguishes trapezial ridge from body fractures.[4,11] Longitudinal injuries of the CMC joint of the thumb are unstable and may be associated with subluxation of the thumb metacarpal, leading to disability if not treated properly.[10] Our case did not fit into any of the groups described by Walker *et al*., but was similar to the type IV injury.[4] The base of the first metacarpal was driven into the trapezium, shearing it into a dorsal small fragment and a volar major fragment. Garavaglia *et al*. reported a case of horizontally displaced fracture, and the authors claim that their fracture pattern did not fit into any of the types described by Walker *et al*.[11] [Figure 4].

Two types of injuries are thought to produce trapezium fractures. An indirect trauma by a fall on the out-stretched hand, where the hand goes into hyperextension and radial deviation, the trapezium getting compressed between the base of the first metacarpal and the radial styloid,[2,12] is thought to be one mechanism. The trapezium fractures between the metacarpal and the radial styloid acting as the "anvil".[13] A direct trauma to the dorsoradial aspect of the hand also has been found to result in the trapezium fracture where the thumb is driven into the trapezium.[14] A fall on the hand in radial deviation and dorsiflexion was thought as the possible mechanism in our patient.

The clinical findings in trapezium fractures are usually minimal, with no gross deformity, and almost full range of movements of the wrist and fingers.[4,5,12] Only the terminal range of opposition of the thumb is usually impaired.

Standard anteroposterior, lateral and oblique views of the wrist sometimes fail to detect the fractures, especially the fracture of the ridge of the trapezium. Here a carpal tunnel view may be helpful.[15] Trapezial body fractures are difficult to detect on routine radiographs because of the overlap by the trapezoid shadow.[4]

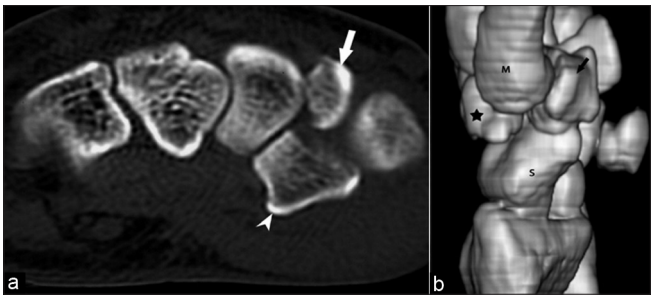

Figure 2: CT scan (a) showing a major volar fragment (arrow head) and smaller dorsal fragment (white arrow) (b) 3D reconstruction CT scan showing the volar fragment (black arrow), dorsal fragment (black star), Scaphoid (S), and the first metacarpal (M)

Figure 3: (a) Postoperative radiograph showing the fixation with K-wires and a mini fixator (b) radiographs at 1-year follow-up showing healed fracture with congruent joints

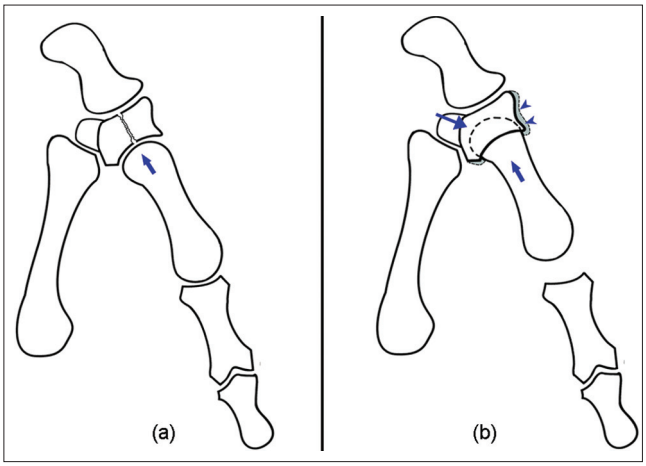

Figure 4: Line drawing showing the (a) Walker type IV fracture and (b) the fracture pattern in this case report

A true anteroposterior view (Robert's view), done with the hand in full pronation, outlines the trapezium and the base of the first metacarpal clearly.[6,8,10] A CT scan helps in fractures which are not visualized in the plain films and also

in finding out the amount of displacement and the size of the fragments.

Associated injuries reported include fracture of the proximal pole of the scaphoid,[3,16] fracture of the thumb metacarpal,[1,13] fracture of the distal radius,[4] fracture of other metacarpals,[4] and fracture of other carpals, including trapezoid and capitate.[4]

The trapezium fracture has to be accurately reduced and fixed to prevent contracture of the first web space and stiffness of the CMC joint otherwise it results in impairment of function due to pain, limitation of movements, or weakness of the thumb.[2] In conservatively managed patients by closed reduction and plaster cast immobilization more than 60% had either persistent pain, swelling, or limitation of movements of the wrist. The secondary displacement is likely to occur in plaster cast.[2]

There are reports of closed manipulative reduction followed by percutaneous Kirschner wire fixation, leading to good functional outcome.[5,17] Various fixation methods have been used. These include headless screw fixation,[3,6,7] 3 mm cannulated screws,[8] 1.5 mm cortical screws,[9] and 2.7 mm screw fixation.[10]

The reported methods of immobilizing the CMC joint after trapezium fixation include plaster cast immobilization, percutaneous intermetacarpal K wires[4,12] to external fixation.[4]

There are few reports of external fixation with distraction applied for comminuted fractures of the trapezium, where internal fixation was not possible.[1] The authors found external fixation as the suitable method since the trapezium fracture was found comminuted and slightly collapsed, in their reported open injury.[1] Walker *et al*. recommended external fixation with ligamentotaxis in comminuted fractures (Walker V), or cross pinning of the first and second metacarpals.[4] Since the base of the first metacarpal exerts pressure on the trapezium, there should be continued distraction across the CMC joint to relieve the pressure on the joint and the cartilaginous surface of the trapezium. An external fixator neutralizes the action of the abductor pollicis longus and the adductor pollicis longus on the first metacarpal. In our patient since the fracture became fragmented at attempted screw fixation, we thought ligamentotaxis with a mini-fixator would reduce the articular surface pressures. Trapezial fractures could be easily overlooked in the emergency room due to its rarity and due to the complex arrangements of the carpal bones. Special projections, such as Robert's view, Bett's view, carpal tunnel view or 3 dimensional CT scan, are mandatory as any articular incongruity leads to secondary arthritis.

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How to cite this article: Suresh SS. Isolated coronal split fracture of the trapezium. Indian J Orthop 2012;46:99-101.

Source of Support: Nil, **Conflict of Interest:** None.